orthogonal code words can be obtained when there are N pulses in the LA-CDMA code. Introducing different orthogonal frequencies to different pulses in the LA-CDMA code, especially when the pulse compression method is employed, the finally acquired code is a compound code of the basic LA-CDMA code and the chosen pulse compression code. According to compound encoding theory, the property of a compound code is mainly determined by the code with worse performance of two elements of the compound code. Thus, when a pulse compression code is chosen poorly, the final properties of the auto-correlation and cross-correlation function will worsen. When every pulse is "isolated" by orthogonal frequencies, the pulse compression code will be "isolated" too, minimizing degradation accordingly and increasing room for choices greatly. For instance, still considering a 16-pulse LA-CDMA code with a period of 847, when 16 orthogonal frequencies are introduced and a 32-bit orthogonal code serves as the pulse compression code, a total of 16X16X32 (= 8192) orthogonal code words are obtained.

The third solution is to relax the restriction of orthogonality, i.e. to adopt quasi-orthogonality which uses imperfect orthogonal codes, to increase the number of users. For example, considering an LA-CDMA code with N pulses, as the order of N basic intervals has no affect on its auto-correlation and cross-correlation functions, it

can be arbitrary. When a code group with various orders of basic intervals is exploited at the same time, the number of users will increase enormously. This can also serve as a solution for reducing interference of adjacent service areas or channels.

Figure 9 is a block diagram of a receiver 10 for a LA-CDMA random access code division multiple access wireless system exploiting one embodiment of this invention. This system adopts 16-pulse LA-CDMA codes and 4 orthogonal frequencies, and can accommodate 64 users signaling simultaneously. The basic structures of a transmitter and a receiver may be readily ascertained once the information basic formula and modulation mode are decided. Of course, detailed implementations may entail some modification according to practical situations. For example, a receiver can be realized either by a matched filter or by a correlator. They both implement correlation operations, and have no distinction essentially. In these cases, a transmitter must generate required modulated waveforms that can be demodulated by computation. Generally, the receiver's structure is comparatively simple, such that a wireless telecommunication engineer can design it in the light of basic modulated signal waveform.

The 16-pulse LA-CDMA code with a period of 847 shown in Figure 1 is adopted as a multiple access code in this system. Moreover, it utilizes 4 orthogonal frequencies,

and each frequency's interval is the reciprocal of the basic pulse's duration. A relative coding pulse compression method is employed to generate the basic LA-CDMA code, with modulation performed using binary phase-shift keying ("BPSK"), and with a pulse compression code of a 13-bit Barker sequence, which is 1 1 1 1 1 -1 -1 1 1 -1 1 -1 1.

Users are permitted to transmit using random access, and to receive by a matched filter. The figure depicts a receiver's block diagram for a certain orthogonal frequency. An analog signal from an intermediate frequency amplifier is converted to a digital signal by an analog to digital converter 11. The system 10 detects a 13-bit Barker sequence using a pulse shape matched filter 12 that includes a 13-bit digital tap delay line 14, multipliers 16 with a 13-bit stage shift register 15, a low pass filter 18 and a weak signal rejector or small signal depressor 20. An 808-bit digital tap delay line 22 and an additional logic circuit 24, which is another part of the receiver, form a pulse position matched filter 26.

The pulse shape matched filter 26 forms pulses of the basic LA-CDMA code, while the pulse position matched filter implements a match operation on the LA-CDMA code. A pulse position matched filter can implement match operations on 16 orthogonal LA-CDMA code simultaneously.